Field Investigations of Reference Concentration for Sediment Transport Models

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LONG-TERM GOALS

The scientific focus of this project is to better understand and predict reference concentration above the seabed. Models of sediment transport depend on parameterization of the near-bed concentration of suspended sediment (or "reference concentration") in terms of dynamical and sedimentological measures. We will evaluate the accuracy and suitability of existing expressions for reference concentration, and based on our field investigations, provide improved definition of this important parameter.

This work will be accomplished as part of ONR-sponsored Mine Burial Research Program. It will be coordinated with other investigators who are working together to understand the oceanographic and seafloor processes that affect bottom mines. The principal goal of this research is to develop a specification of the reference concentration that is tested and supported by high-quality field measurements for different sedimentological and dynamical conditions in shallow-water environments.

OBJECTIVES

- Evaluate existing formulations for reference concentration C_o and their applicability for sediment transport modeling.

- Obtain high-quality field measurements of important parameters that contribute to better understanding of C_o. These include detailed near-bed measurements of velocity and suspended sediment concentrations, size distributions and settling velocities of near-bottom suspended sediment, and bed conditions.

- Determine relationships between bottom stresses in shallow-water marine environments and near-bottom suspended sediment concentrations.

- Develop an accurate expression for C_o.

APPROACH

Our approach is to carry out a series of field studies to obtain data that can be used to investigate C_o. These data will include, but may not be limited to, near-bottom velocity profiles, suspended sediment concentrations and sizes close to the seabed, bottom sediment sizes, and bed roughness. We will work in conjunction with Dr. Yogi Agrawal, Sequoia Scientific Inc., in carrying out the field work and post-

field analysis. The present plan is to conduct a pilot experiment using unique instrumentation at a coastal site off California (possibly off the main pier at Santa Cruz, CA) in November or December, 2001. This experiment will provide test and calibration of new equipment and techniques, as well as initial data for analysis.

We propose to use new and unique instruments to collect field data over a wide range of conditions, along with supporting wave and current measurements obtained near the bottom. A high-resolution sector-scanning sonar capable of resolving small-scale bedforms will be used for these experiments to determine bottom morphology.

The second experiment will be carried out in collaboration with other major investigators in the Mine Burial Program at a site to be determined. This second experiment will provide a longer time sequence of measurements in a dynamic shallow-water, open-shelf environment. We anticipate that the bottom conditions will be sandy, and that both waves and currents will be important hydrodynamic processes.

WORK COMPLETED

This project was initiated a short time ago. We are presently ordering equipment and designing the initial pilot experiment.

RESULTS

No results are available at this time.

IMPACT/APPLICATIONS

The results from this proposed work will make important contributions to ongoing modeling efforts in the Mine Burial Program, and to subsequent sediment transport modeling research. Most sediment transport models that have been developed for shallow ocean conditions require specification of the relationships between bottom stresses or shears to concentrations of suspended sediment near the bed. This work will improve this aspect of our understanding and improve modeling of sediment transport.

TRANSITIONS

This work is part of the larger ONR Mine Burial Program efforts. It will be directly integrated into the overall understanding of how mines react to physical processes in shallow water, and into improved sediment transport models.

RELATED PROJECTS

This project is directly linked to one undertaken by Dr. Yogi Agrawal, Sequoia Scientific, Inc. We will work closely on field and analysis aspects of the research. Other key collaborators are Dr. Peter Howd, U. of South Florida, and Dr. Peter Traykovski and Dr. Steve Elgar, Woods Hole Oceanographic Institution.